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EXPERIENCES IN

MECHANICAL HARVESTING OF CHERRIES

Requirements Necessary To Make It Successful

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A PANEL DISCUSSION

Conducted by

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EXPERIENCES IN MECHANICAL HARVESTING OF CHERRIES

Panel Discussion

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GASTON: As many of you know, the research team of Levin, Hedden and Gaston which I represent, is sponsored jointly by the U.S. Department of Agriculture and Michigan State University. Our group began its studies of mechanical harvesting in 1956. Progress reports were presented at the 1958 and 1959 meetings of the State Horticultural Society. In May of this year (1960) our findings were made available in the form of a Michigan State University publication entitled, "Mechanizing the Harvest of Red Tart Cherries." All of these reports stressed the fact that although the basic principles of mechanized picking had been established the necessary equipment had not been perfected.

In spite of the fact that no specific equipment recommendations have been made, the shortage of competent harvest labor and the efforts that are being made to organize the workers who are available, have led many growers to conclude that harvest mechanization is a matter of great urgency.

Because of the feeling that machines will have to be found to replace the pickers who are no longer readily available, and the desire to reduce harvesting costs, there were twenty-four Michigan growers who used machines in harvesting commercial cherry plantings during the 1960 season. Cherry processors realize that mechanization is here to stay, and they not only packed the machine-picked cherries but kept records, studied quality and cooperated in many other ways.

In addition to carrying on experimental studies of some of the technical aspects of the work, our research team acted as a clearing house for mechanized harvesting information obtained by growers and processors. Early last month all of the Michigan producers who were known to have used mechanical pickers in harvesting cherries during the season just passed were invited to a meeting at Michigan State University. On this occasion they were given an opportunity to discuss the results of this year's work and outline their plans for next season.

This exchange of ideas between the members of our research group and growers who had had actual experience in machine picking brought out a great deal of interesting and useful information. I am sure that everyone who attended this meeting learned things which will help make their 1961 operations more effective. The round table discussion was, in fact, so successful that it was decided to use the same method and several of

the same people in bringing the members of the State Horticultural Society up to date on the subject of picking cherries with machines.

We have on the platform this afternoon a panel made up of three growers who used machines, one of the processors who packed machine picked fruit and a member of the Michigan State University staff who will discuss pruning as it relates to mechanized picking. I am sure that you will be interested in what these gentlemen have to say. We are going to give each of them an opportunity to discuss an important phase of mechanization. After these presentations you will, if time permits, be given an opportunity to ask questions.

Mr. Robert Seaberg of Traverse City, Michigan, has had two years of experience in mechanical picking. He has harvested both sweet and tart cherries with machines. Mr. Seaberg is interested in mechanization from the point of view of a grower, and of a manufacturer of harvesting equipment. Mr. Seaberg.

ROBERT SEABERG: Our first experience in mechanical harvesting of cherries was in 1959. Cherry Growers Inc., a co-op processing plant in Traverse City purchased a Gould Shaker for the purpose of conducting experiments on the quality of mechanically harvested and handled cherries.

We were fortunate that our farm was selected for these experiments, which were carried on under the direction of Leonard Sobkowski, plant engineer of Cherry Growers, Inc.

Leonard secured the services of Dr. Robert Wittenberger of Product Utilization, USDA; Jordon Levin, USDA, who is in charge of all research in connection with mechanical harvesting; Scott Hedden, USDA, Agricultural Engineering. Heddon has been responsible for many of the designs of mechanical harvesting equipment. Seaberg Orchards is very much indebted to these men for the information made available to us as a result of these experiments.

The catching frames used were very simple, constructed of tubular material with 17-degree incline and covered with a 12 oz. duck canvas stretched tight enough to prevent pocketing of fruit. The angle was sufficient to insure a good roll-off, which resulted in a minimum of bruises.

We were not attempting to harvest commercially. We harvested only four or five trees per day. We made comparisons each day of mechanically harvested and hand picked fruit. We had regular USDA inspection of fruit. We also made comparisons of the processed yield of each. In every respect the mechanically harvested fruit was equal to the hand picked fruit.

The one sad note of this experiment was the amount of bark injury to the trees, which we considered severe.

The 1960 season saw the beginning of harvesting commercially. We used the same type of catching frames that we had experimented with, because we knew that type produced a minimum of bruising. The fruit was collected in canvas boxes 16 in. wide by 6 ft. long. Four boxes per tree were used.

We had three frames, two of which were fixed-angle frames, and the third frame would tilt from one direction to the other. This enabled us to harvest two rows at a time. While one tree was being harvested the fixed frame and collecting boxes were placed in position at the next tree

in the other row. In this way we were able to harvest an average of fifteen trees per hour.

We used a Harrett Harvester and I am happy to say we had no bark injury with this machine.

We are only eight miles from our processing plant in Traverse City, so we hauled all of our mechanically harvested cherries and a portion of our hand picked cherries in trailer tanks that hold approx. 200 lugs each. We used two of these tanks, so while one was on the road the other was being filled. We tried to have the fruit in these tanks less than 2 hours. We hauled about 200 tons in this manner. Our labor cost saving in water hauling of hand picked fruit was $3.00 per ton.

In selecting the portions of our orchards for mechanical harvesting we chose two extremes: 5 acres of an old orchard (in no way adapted for mechanical harvest); heavily infected with virus and a poor crop; 5 acres of a twelve-year-old orchard that had been pruned with mechanical harvest in mind; no virus and an excellent crop.

We harvested the old orchard first. This probably increased the cost because this is where our work crew got its training. The crop in this block was poor enough to have cost us $1.00 per lug for picking, had we picked it by hand.

When I make these comparisons as to cost of harvesting by both methods I include all the cost involved in supervision and handling as well as picking. The total cost of mechanical harvest in this block was $38.00 per ton.

Our quality due to wind damage was not too good. Our stem count was high, between 8 and 12 per cent.

When we moved into the young trees which had a good crop, our labor costs dropped to $9.25 per ton. Quality was excellent, stem count down to 2 per cent. Our cost of hand picking this past year was $53.00 per ton. In comparing these costs, there is nothing for depreciation of equipment or housing of pickers included in either method.

Our plans for next year are to expand the operation to 100 or 120 tons. In order to do this we will have to add one or two tank trailers and put down another well, as we've learned that it requires at least one thousand gallons of water per hour to cool an average day's pick of 20 to 25 tons of fruit.

Our experiments in 1959 taught us that cherries will scald faster in water than out of it unless the water temperature is kept under 60° F. We also plan on using the same catching frames with a few minor improvements.

In summary I would like to say that I believe our cherries were of good quality this year, and that is why we are reluctant to make any changes in our equipment until we are sure that we have something better.

We are convinced that the catching equipment is by far the most important part of the operation and should be selected very carefully if fruit quality is to be maintained.

I am adding a few observations to insure good quality of fruit. All pocketing of any kind must be avoided. Too steep a slope of the frame is as harmful as not enough slope. The cover should be of a material that is resilient enough to absorb the shock of fruit hitting it without any rebound. Avoid hard surfaces.

A heavy canvas cover will cause more bruising than a light one. A

treated canvas of any weight will cause more bruising than an untreated one. A 12 oz. weight untreated canvas gave the least bruising of any material tried.

As a grower, I am sure that mechanical harvesting is here, that it is practical and that it will save labor and reduce harvest costs by at least 50 per cent. I feel certain that mechanical harvesting will increase rapidly from now on if we growers keep quality as our goal.

GASTON: Mr. John Steimle's cherry orchard is located on relatively level ground; the trees are high-headed and spaced 27 feet apart. In other words his orchard is well suited to mechanized picking. He is going to tell us about the results he achieved during the season just past.

JOHN STEIMLE: About a year ago we started to think of mechanical harvesting of cherries. Before this time, we had heard of it, but believed it was a prospect for the far future. But as we listened to such meetings as the U.S.D.A. research team attended, and to other growers' stories, we began to realize that maybe we could get in on the ground floor. Not only because of the pinch in the rising cost of production but also in trying to alleviate some of the migrant labor problems.

After definitely deciding to shake cherries, of course we had to decide how we were going to catch them. To make a long story short we agreed to work with Dave Friday who specializes in masterminding particular machinery. As far as I'm concerned the frames *are* a masterpiece, for working as they did the first time in the field.

As the frames were finished and ready for production, we had the whole harvesting season all planned. The U.S.D.A. team told us we were going to shake 12 trees an hour or else there was something wrong with our system. So we had it all planned, so many trees, so many hours—we'll get done in so much time. Fine, so we hired only about 25% of our normal working crew. The first hour in the field we shook four trees. What was the matter? After shaking for a few hours, it began to dawn on us that the research teams didn't say how many pounds per hour we were going to shake. In their studies where they would shake 12 trees they would only get 700 to 1000 pounds per hour. Whereas, we had up to 700 pounds on some of our exceptional trees. We probably averaged about 8 trees per hour which gave us over 300 pounds per tree average. This means we were shaking over twice as many cherries per hour.

Prior to harvest we had two small hail storms that left an opening for rot to start. Therefore we had quite a job of sorting. We provided places on the frames for sorters and did a fair job of getting rid of the bad cherries. All of our grades were 87 and above. Our stem grade was very good—three per cent was the highest grade. There were a lot of grade sheets with zero per cent stems. If it hadn't been for our scald problem, the grades would have been much better. The sorting on the frames also slowed the shaking process so that we weren't shaking at full capacity. I believe we would be better off if we would transport the cherries from the frames in lugs to a grader belt at tank truck station. There they could be graded and run directly into the truck for shipment to the processor.

We believe our scald was coming from the small water tanks that were set directly on the frames for carrying the cherries to the tank truck. The water displacement was so small that it couldn't keep the cherries cool. However, we must realize that maybe this will only be a problem in

the southern regions where the temperatures are warmer than in the north.

We realized quite a bit of bark damage. This was caused by air in the hydraulic claw line on the Gould Shaker. This would allow the claw some slack and cause a bouncing effect on the tree. The actual damage doesn't look bad today and I don't believe it will mean much.

The only thing I can say about quality is that we have room for improvement. A lot of our mechanically harvested cherries fell flat on the processing line. But so did a lot of hand picked ones too.

The performance of the frames on the whole was very good. We had only six hours "down time" the whole season. But there were many hours of crossed fingers. Of course there are a lot of improvements which will be made for next year. We harvested ninety tons of cherries mechanically at a cost of seven-tenths of a cent actual labor. Cost of machinery will have to be based on the number of years to be depreciated.

We feel that mechanical harvesting is here to stay. With the cooperation we've had in trading ideas from growers and manufacturers, we can't help but make it. This is what we need not only in mechanical harvesting but in other phases of fruit growing if we are going to stay in business.

GASTON: Mr. Rodney Bull, of Bailey, was the first Michigan fruit grower to use a fork lift truck in his orchard. He was also one of the first to use bulk boxes in handling fruit. It is not surprising that we find him pioneering the use of cherry harvesting machines. Mr. Bull.

RODNEY BULL: Last year at the Hort Show I bought a Gould Shaker, went home and proceeded to dream about catching frames all winter. We would dream up one design, find the faults and start dreaming again. By the time spring came we were no closer to starting to build than at the beginning of winter. We then made a trip around the state looking at all of the catching frames we could find that had been in operation the previous year, trying to benefit from other people's successes and failures before we started to make our own mistakes. At this point we not only did not know how to get where we were going, we didn't know where we wanted to go.

I hired a man to do the welding and we started to construct what we thought would work best for us under our conditions. We built one frame on a Jeep ten feet by twenty feet that raised and lowered in all directions by means of hydraulic power. The other side of the frame was built on a small crawler. This frame was slightly larger (being ten feet by twenty feet) and having a conveyor across the bottom and an elevator on one end which raised the cherries and dumped them into a one-ton tank that was carried on a forklift tractor.

We finished the frames about one week before cherries were ripe in our area, loaded a few trucks which looked like a wagon train, and went to southern Michigan to try out the frames and get some of the bugs out of the equipment before we we were ready to start picking in our area.

The first several days we accomplished practically nothing as far as picking cherries was concerned. We experimented and modified the equipment to get more speed and maneuverability out of it. At the end of five days of experimenting, we moved back home and felt we were much closer to having a machine ready to start the season with, than we were a week before. But we still had a long way to go and a great

deal to learn. And, incidentally still do before we have a smooth running operation.

With a few more modifications, we were able to harvest about twenty trees per hour of operating time. I insert that "operating time" to show that a great part of the time we were either modifying or repairing. We still were not getting much tonnage inasmuch as our crop was very light.

About this time we started running into quality problems. We process our own cherries and bruising was very serious. However, it was not the type of damage that would be scored by our federal inspector. The grades that we received were quite satisfactory. There was enough severe bruising that our plant production was cut nearly in half and our yield dropped from about 78% on hand-picked cherries to about 60% on shaker cherries and we were still attempting to maintain a grade quality.

With figures like that staring us in the face we started to try to find out why. We spent several days trying to determine the points where we were receiving damage and then we made another tour of orchards using shakers and discovered much the same conditions in most orchards.

We felt that there were a multitude of places where damage was occurring. When the cherries were shaken from the tree they hit limbs on the way down but it didn't seem serious, when they hit the canvas there was some injury but it didn't seem serious either. We received some more damage when the cherries would pile up or develop pocketing. There was pocketing and rubbing on the conveyor when they went from the conveyor to the elevator, and then up the elevator there was some more damage, none of it very significant but added together it was serious.

We removed the elevator from the machine and caught the cherries in lugs, we speeded up the conveyor, then we eliminated the pocketing, it all helped but still is not satisfactory as far as I am concerned.

Next year we plan to use a concave conveyor and have vertical belts along the horizontal belts of our elevator to prevent the fruit from sliding up the sides of the elevator. We also plan to use foam rubber strips stretched about six inches above a smooth aluminum catching frame. The foam strips will catch the fruit and let it drop gently onto the aluminum sheet. The aluminum sheet is used in preference to canvas to eliminate pocketing.

If we can reduces the damage in several places throughout the operation I am sure that we can successfully shake cherries. If the problem is not recognized and cured, the processors will be forced to discount shaker cherries to the point at which it will not be feasible to harvest this fruit mechanically.

But I am confident that there are no insurmountable problems. We will find the answers and will have a good product to deliver to our processors, as well as have a little more money to operate our cherry industry and profit left for the growers of red tart cherries.

I have thoroughly enjoyed working with this equipment and I am looking forward to using it on other fruits. I also feel that it is a big step toward the mechanization of the fruit industry.

GASTON: Cherry harvesting machines cannot be used to advantage unless cherry processors are willing to buy machine-picked fruit. Cherry Growers, Incorporated, of Traverse City, was the first processor to pack large quantities of machine-picked cherries. Mr. Leonard Sobkowski is

in charge of that part of their packing program which has to do with machine-picked cherries. Mr. Sobkowski.

LEONARD SOBKOWSKI: I should like to make a change in the title of my presentation from "The Processor's Problems" to "Cherry Industry Problems Created by Mechanical Harvesting." Cherry Growers, Inc., a grower cooperative, has been interested in this harvesting method from the beginning, operating their own shaker on an experimental basis in the 1959 season. Last season, seven operators delivered 4% of our receipts, approximately 65% of total state tonnage so harvested.

We, too, have been encouraged by the economies and conservation of man power which seem possible with this system of harvesting. Our management had authorized the purchase and installation of $6,000 worth of continuous weighing equipment for water hauled mechanically harvested fruit, the rental of a mechanical stemmer, and a test program to study the effects on quality of shaken cherries.

All this then may qualify us as sympathetic, constructive critics of this new method of harvesting and handling cherries which may involve 95% of our receipts within the near future.

All interest has been focused on the harvesting aspects and slight consideration given to the raw fruit quality, the ultimate yield, and the finished quality of fruit so harvested. It is now fitting that the Departments of Horticulture and Food Science of Michigan State University participate with their skilled and trained personnel in studies of quality of mechanically harvested fruit, from the very orchard to the finished product. This work needs to be carried out before methods now in existence are accepted as precedent and the momentum becomes too great for prompt change when necessary.

The following listing includes malpractices which affect quality of mechanically harvested cherries:

1. *Attached Stems*

The presence of high percentages of attached stems has formerly been associated with maturity and it was felt that as harvest progressed, the incidence of attached stems would diminish.

Contradictions have appeared which indicate the possible influences of fertilization, climate, spray programs, and the crop size. Research work by the Horticulture Department might result in recommended practices to reduce or eliminate attached stems in Mechanical Harvesting.

In the meantime, tests performed by CGI during the 1960 season indicate the possibility of successfully removing attached stems with the use of equipment commonly used for that purpose in the maraschino cherry industry. Minor modifications to the Atlas-Pacific machine may enable the softer fresh Mont. cherry to be safely handled at high efficiency. Continued confirming research is necessary before final recommendations can be made.

2. *On-The-Tree Defects*

Hand picking methods have enabled the grower to judge picker performance and obtain a certain amount of sorting service for the Standard picking fee. This past season, the Steimle Orchards, in conjunction with Mechanical Harvesting, used a Friday mechanized collection frame

that discharged cherries onto horizontal conveyors and thus enabled sorters to pick out defects. They were able to raise the grade up to 5% by this sorting. All other growers practicing Mechanical Harvesting made little or no effort to perform sorting before discharge into water. Thus it is apparent that the quality of the Mechanically Harvested fruit is essentially that of the on-the-tree quality as for the identifiable defects. Fruit with weather- or disease-caused defects in excess of what is considered normal, may place an unreasonable labor load on the packer's present facilities even though the grower be penalized for these defects.

I suggest that growers interested in Mechanical Harvesting consider the necessity of sorting facilities incorporated into the catching frame equipment.

At this point I might mention that our grower-operators have been practicing blending of handpicked fruit with shaker fruit in the average ratio of 3 to 1. As mechanized harvesting becomes perfected that ratio may reverse to 1 to 3 and eventually 100% shaker. What happens then to the member who blended 3 parts handpicked to 1 part shaken and lowered an 87% grade to an 84% grade with his 73% grade of shaken fruit? He would end up with a blend grade of 77% of which 3% is scored for decay, 14% for windwhip and 6% for attached stems. If he had carried on sorting before tanking and had been able to shake stem-free, his grade could end up being 88%. I must admit this was an extreme case; our other operators did much better. It does serve to show how poor on-the-tree quality fruit can come into packers' plants.

If all this isn't reason enough to proceed cautiously, I have saved the biggest headache for the last.

3. *Defects Caused by Mechanical Harvesting and Bulk Water Handling*

The pre-war copper-sprayed cherry makes a high standard to live up to. It would lend itself to the shaking, catching, conveying, and bulk handling we need in this business. That war is long gone, and now in most seasons our orchards produce cherries that are larger, softer, lighter in color, lower in soluble solids, higher in moisture content, and a real sissy. Can you remember when a 5 or 6 week season didn't worry you as a 3 week season does now, as far as windwhipping is concerned?

The immature fruit is fairly firm but as it ripens it becomes less firm until dehydration takes effect and it gains firmness to the point of shriveling. It is that middle period when the bulk of harvesting occurs that we have most of our bruise trouble. This mature, freshly picked or shaken cherry is at its most tender stage. Bruising inflicted by the following conditions may result in scald.

A. Collision with tree branches and trunk.
B. Collision with shaker boom and mechanism.
C. Impact on catching frame surface and unpadded frame structure.
D. Drops and falls during course of travel along conveyor system.
E. Crushing due to insufficient water cushion in water tank.
F. Other miscellaneous actions that tend to exert excessive pressures upon the soft fruit.

Bruising to a cherry is not "what the doctor ordered." If it happens on the tree during the growing season it leaves a "calling card" that looks like wind-whip, limb-rub, dents and others marks. When a cherry is bruised during harvesting operations it may be moderate or severe. Severe

bruising should not be tolerated, steps should be taken to eliminate it. Equipment alterations and changes in operating techniques can do much to prevent most severe bruising. On the other hand, since it may not be possible to eliminate moderate bruising, its effects can be minimized. Prompt chilling in cold water tends to promote a healing and firming action. Unless this is done, bruises are manifested as scald blemishes which may increase up to 22 times in a 2-hour delay of cooling. The initial chilling is but part of the job. Test work by the USDA has indicated the following:

A. Bruised cherries consume more oxygen than unbruised cherries.
B. A 25 degree F. temperature increase of soak water increases respiratory rate of cherries 5 fold.
C. Unbruised fruit is not affected by decrease in oxygen or slight increase in temperature.
D. Cold water that rises in temperature and has lost its oxygen causes increased scald formation of bruised fruit.

So now you can understand why your cherry packer keeps cold water running continuously through his firming tanks. The price you must pay for unscalded fruit in bulk water handling is the effort you must make to supply changes of fresh cold water in orchard pallet tanks, trailer tanks, storage tanks or tank trucks. Otherwise your bruised cherry becomes a scalded cherry with its "leach" loss in the firming tank, loss of firmness and color after storage, heavy pick-out for grade, increased pitter loss, and reduced drain weight. Most raw fruit inspectors will not interpet bruising as a scorable defect unless it be so severe as to be classified as lug scald or mutilation.

The continuing trend in cherry packing is toward a higher percentage of the fruit going to freezers, and while scalded cherries may make an "A" grade when canned, they will grade "C" or sub-standard in frozen pack. Fruit costs are the packer's highest costs and he may soon find that it is unprofitable to subsidize mechanical harvesting unless raw fruit quality is improved.

In conclusion, mechanical harvesting is an exciting solution to the fruit industry's grave problem. Cherry Growers, Incorporated, stands ready to help refine this system to the point at which it will be possible to use machines without lowering the quality of the pack.

GASTON: If mechanized harvesting is to become successful, horticulturalists and engineers are going to have to work together. The effectiveness of mechanization, as we know it now, depends to a considerable extent on how the orchard is pruned. Dr. Larsen, a member of the Michigan State University staff, is going to discuss the relationship between pruning and mechanical picking. Dr. Larsen.

DR. PAUL LARSEN: "Figs do not grow upon thistles, neither good fruits upon the unpruned tree."

These few simple words from a little parable about pruning, perhaps express a fruit grower's thoughts in the winter time and add a basis for our discussion here.

Fruit trees are pruned to give them a desired form, to produce a strong, well-balanced tree that will support much fruit in the future. They are pruned to prevent overbearing, to thin the crop and improve the grade of fruit; to remove dead, diseased, broken and other undesirable branches and superfluous growths. They are pruned to remove weak, unproduc-

tive wood, to thin the centers and sides for easier admittance of sunlight, air and spray materials, and to lower the tops if necessary to make spraying or harvesting easier. Now they are also pruned for mechanical harvesting.

Pruning cherry trees for mechanical harvesting does not eliminate or reduce the need for any good pruning fundamentals. Whether the trees are trained and pruned for hand harvesting or mechanical harvesting they must have strong, well-balanced frames that will bear profitable crops over a relatively long period of time. The differences lie in how the tree's structure or framework is attained.

Training Young Trees

Untrained sour cherry trees form close scaffold branches with narrow crotches which split off when they begin to bear. Careful training to a modified leader will prevent such damage. Sour cherries, trained for hand harvesting, usually have the lowest scaffold branch arising about 18-24 inches above the ground. Additional scaffolds are spaced 6-8 inches apart with a total of 6-8 main scaffold branches.

No one knows for sure, how cherry trees should be trained today for mechanical harvesting at the time they will come into bearing. Trees that are trained for today's shakers and catching frames may not fit the harvesting equipment that may be here five years from now, when they start to bear, and what may be right for one grower may not be good at all for another.

With these thoughts in mind, however, there still remain two obvious faults of present trees in regard to their suitability for mechanical harvesting: (1) Most cherry trees are too low; the lowest scaffold branch should be 30 or more inches above the ground, (2) There are usually too many scaffold branches; present shaking equipment should only have to make 3 or 4 points of attachment on any one tree.

Trees can be trained to avoid these faults without sacrificing the strong framework of a modified leader tree. Careful attention during the early years of the tree's life is a must. The following suggestions may be helpful:

First Pruning (immediately after planting).

Prune tree to a whip. Remove all side branches and cut leader back to 3-3½ feet above the ground.

Second Pruning (1 year after planting)

1. Select the most vigorous upright growing shoot for the leader.
2. Select for a permanent scaffold branch one well-placed branch that forms a wide angle with the trunk and that is about 3 feet above the ground. Remove all other competing branches. Short twigs and shoots may be saved and thinned out in later years.
3. Head back the lateral so it will not overgrow the main leader. The leader should be headed back to about 20 inches above the lateral.

Third Pruning (2 years after planting)

1. Select the highest shoot developed from the leader to continue as the leader.
2. Depending on the previous season growth, save one or two more lateral branches for additional permanent scaffolds. Scaffolds should be

at least 12 inches apart and well spaced around the tree. Head these and previously selected scaffolds back to keep the leader dominant.

3. Thin out unneeded scaffolds. Leave a balanced tree.

Later Prunings

1. If desired select one more scaffold branch, but do not have more than 3 or 4.

2. After the tree is well established with a strong central trunk, the leader can be terminated into the top scaffold.

3. Keep the tree balanced by thinning out and some heading back.

4. Thin out scaffolds as desired for shaker attachments, etc.

Present young trees (2-5 year old) can be pruned to achieve this same result by simply removing the scaffolds which are too close to the ground and thinning out the others. This may appear drastic but remember the trees are flexible and tough. They can take it if you can.

Pruning Older Trees

The mature bearing tree is today's problem for mechanical harvesting. A typical 15 year old sour cherry tree, by design or lack of it, is low to the ground; it has many scaffolds, often with narrow and weak crotches; its best fruiting wood is on the top and sides with weak, unproductive wood in the center; its growth has slowed up, but it bears heavily and sometimes provides a profit, but it is about as well adapted to mechanical harvesting as the Model-T Ford is to today's expressway super-roads.

Whether suited or not, these are the trees that will be harvested mechanically this year, next year and for the next several years.

No one can stand before an audience and give particulars on the best way to prune these mature trees, but these are some points that each grower should consider.

1. Low scaffold branches materially slow up the harvesting operation. They interfere with catching frames and with the movement of personnel and machinery through the orchard, and many do not bear enough fruit to justify their continuing existence.

I recently observed some prune shaking operations in California. Some shaking crews were moving through orchards at the rate of a tree every minute. All low interfering branches on these trees had been removed; there were no low branches for the catching frames and shakers to run into.

A time study on the effect of tree structure on rate of harvesting was conducted in California.[1] In an average orchard where the trees had low branches and 3 to 6 primary limbs per tree a shaker catching frame crew harvested an average of 23 trees per hour. In a similar orchard where the low branches had been removed and average number of main limbs had been reduced to 2-3, the same type of crew and equipment harvested 60 trees per hour. The longer time to harvest a tree in the first case was attributed to poor visibility, interference by the many limbs, more time to move the shaker and more limbs to shake.

2. Most mature trees require too much shaking time to remove the fruit. Present tractor mounted shakers should not have to make more than 4 points of attachment on any one tree. Select the 3 or 4 best scaffolds and remove the rest. The tree may appear open and thin for a year or two, but

1. Adrian, P. A.; R. B. Fridley; and A. D. Rizzi, Pruning for mechanical harvest, Western Fruit Grower, 6:17-18. June, 1960.

the efficiency of your operation will increase by more than the amount of fruit you have pruned off.

3. Try and select branches to leave for shaking that will best fit the shaker that you are using. For example, a Gould shaker is better adapted to vertical branches than those that tend toward a horizontal angle.

4. Thin out the "shaker" branches enough so that the "claw" will not go to the same spot year after year. Some injury often occurs where the shaker hooks onto the branch. This may not be severe in any one year, but if repeated on the same spot the branch might be eventually girdled.

5. Thin out the weak, generally unproductive interior wood. Often this is the wood that has the late ripening fruits which do not readily let loose of their stems when the tree is shaken. The stems and cherries come off together and you are faced with a high stem count.

6. Finally, do not follow any stereotyped system or pattern of pruning. Be flexible; study each tree and then prune it to best suit your own needs. We are just now entering the mechanical harvesting age of fruit plants. Equipment changes will be almost continuous. The trees must change accordingly.

In this regard, there is only one thing that will pay you better than having a sound knowledge of pruning; and that is — to use it.

GASTON: I am sure you will agree that we have had a most interesting discussion. We have looked at mechanized picking from the point of view of the grower, the processor and the horticulturalist. It seems to me that the present situation regarding mechanical cherry picking can be summarized, as follows:

1. Mechanical cherry harvesting has arrived. During the 1960 season 24 Michigan growers used harvesting machines in commercial plantings, and the number is almost sure to increase rapidly. (Growers in other cherry producing areas also used machines during the season just past.)

2. The trend toward mechanized picking is likely to be accelerated by the shortage of competent harvest labor and the desire to reduce harvesting costs.

3. The results so far achieved have varied from fair to excellent. In most cases disappointing results were due to faulty equipment and lack of experience. Methods and machines are, however, being developed which are almost sure to make it possible for the industry to use harvesting machines without lowering the quality of the pack.

4. Growers should prune their trees with mechanized picking in mind; prepare the orchard floor so that picking and collecting equipment can be readily maneuvered; provide themselves with the best available equipment; provide good supervision; make "attachments" with care; avoid over-shaking; enlist the cooperation of processors — their help is essential; keep going but be careful.